REMARKS

In response to the Office action identified above, please accept the following remarks.

Examiner:

1. The IDS, filed 9/26/03, did not include a PTO-1449 with references listed thereon. Therefore, the IDS has not been considered.

Response:

A PTO-1449 with reference listed thereon is attached to this paper. Since the IDS filed on 9/26/03 is before the mailing date of a first Office action on the merits, a petition to request consideration of the IDS is requested according to 37 CFR §1.97(b) and §1.97(f). The applicants sincerely hope that the examiner can consider the document listed on the accompanying form and the IDS filed on 09/26/03.

Examiner:

2. Claims 19, 20, 21, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by US# 6,001,512 to Tzu et al.

Tzu teaches a mask and method of systematically laying out the mask for test patterns in the frame cell region of an attenuating phase shifting mask are described. An array of sub-resolution contact holes are used in the border regions of the mask to prevent over exposure of photoresist in the regions between the device regions on a wafer due to side lobe effect. The mask and method

provide for a buffer distance surrounding the features of the test patterns. The buffer distance is free of sub-resolution contact holes. When the buffer distance is correctly chosen, problems due to side lobe effect at the frame cell portion of the mask are prevented (Abstract). FIG. 2 shows a top view of a part of a mask to be used in a stepper in forming a pattern on an integrated circuit wafer. FIG. 2 shows the device region 12, the border region 14 and the frame cell regions 16. FIG. 3 shows a test pattern to be located in the frame cell region. The test pattern in this example is a box in box pattern having an outer box 22 and an inner box 24 which is to be placed in the frame cell region 16 of the mask. The frame cell region is located in an array of sub-resolution contact holes 20, as shown in FIG. 4. As shown in FIG. 5, the border region 14, which is an array of sub-resolution contact holes 20, surrounds the device region 12. The frame cell region 16 is located in the border region 14 (col. 3, lines 10-25). Other examples of test patterns are shown in FIGS. 9 and 10. Fig. 9 shows a test line test pattern having three test lines 34, 36, and 38 surrounded by a buffer distance 30 before beginning the pattern of sub-resolution contact holes 20. FIG. 10 shows a critical dimension test pattern having an array of shapes 40 representing critical dimensions each surrounded by a buffer distance 30 before beginning the pattern of sub-resolution contact holes 20 (col. 3, line 62-col. 4, line 2).

The three lines 34, 36, and 38 or the shapes 40 are the integrated circuit layout and the surrounding region is the at least one blank region. The sub-resolution contact holes are the plurality of dummy patterns. These patterns do not resolve. Because the holes prevent over-exposure of the photoresist and the buffer region is correctly chosen to prevent side lobe effect, the dummy patterns reduce the difference in pattern density so as to modify optical proximity correction. Tzu teaches exposure of the mask at least in

the abstract.

Response:

Claim 19 has been amended in the above AMENDMENTS TO THE CLAIMS section to introduce the limitations of comprising dense figures and at least one isolated figure in the integrated circuit layout. The dense figures and the isolated figure introduced into the amended claim 19 are disclosed in Fig. 5 of the present application. In the semiconductor manufacturing processes, the definition of the dense or isolated figure is already well known for those skilled in the art. No new matter has been introduced.

In order to point out the difference between the amended claim 19 of the present application and Tzu et al.'s method, the amended claim 19 is repeated below for convenience:

Claim 19: An optical proximity correction (OPC) method for reducing optical proximity effect occurring in a pattern transferring process, the method comprising:

providing a photo-mask;

providing an integrated circuit layout predetermined to be formed on a surface of the photo-mask, **the integrated circuit layout comprising dense figures and at least one isolated figure;**

performing a partial OPC of the integrated circuit layout for obtaining a corrected integrated circuit layout; and

forming the corrected integrated circuit layout on the surface of the photo-mask and forming a plurality of dummy patterns surrounding the isolated figure of the corrected integrated circuit layout on the surface of the photo-mask, the dummy patterns being capable of reducing the difference in pattern density of the corrected integrated circuit layout.

As disclosed in the amended claim 19, the OPC method forms a plurality of dummy patterns surrounding the isolated figure of the integrated circuit layout, so as to reduce the pattern density difference between the dense figures and the isolated figure. As shown in FIG. 2 and FIG. 9 of Tzu et al.'s disclosure, however, the sub-resolution contact holes 20 are formed in the border region 14 to surround the test lines 34, 36, and 38. Tzu et al. never teaches that the test lines 34, 36, and 38 have different pattern density. In fact, the test lines 34, 36, and 38 formed in the border region 14 are believed to belong to isolated lines to facilitate the execution of circuit testing. Therefore, the test lines 34, 36, and 38 taught by Tzu et al. cannot be read as the integrated circuit layout of the present application because they obviously cannot provide the advantages of the present application, such as to reduce the difference in pattern density of the integrated circuit layout for modifying optical proximity effect.

In addition, the amended claim 19 of the present application also discloses the steps of performing a partial OPC of the integrated circuit layout for obtaining a corrected integrated circuit layout, and forming the corrected integrated circuit layout on the surface of the photo-mask before forming the dummy patterns surrounding the isolated figure of the corrected integrated circuit layout on the surface of the photo-mask. However, Tzu et al. never teaches the steps of performing the partial OPC for obtaining corrected integrated circuit layout and forming the corrected integrated circuit layout on the photo-mask before forming the sub-resolution contact holes 20. The Applicants therefore respectfully believe that the amended claim 19 is substantially different from Tzu et al.'s invention. Reconsideration of the amended claim 19 is requested.

As claims 20-23 are dependent upon the amended claim 19, they should be allowed if the amended claim 19 is allowed. Reconsideration of claims 20-23 is therefore requested.

Examiner:

3. Claims 24, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over US# 6,001,512 to Tzu et al.

Tzu teaches the limitations discussed above in paragraph 2. Tzu does not specifically teach the multiple ranges recited in claims 24-26. Because the contact holes are sub-resolution, it is an obvious variation of the design size of the contact holes to be less than a multiple of 0.6 of the exposure wavelength or greater than a multiple of 0.3 of the exposure wavelength. Also, the buffer distance is chosen to avoid side lobe effects, therefore, the distance of 0.4 to 2.0 of the exposure wavelength is obvious.

Response:

As claims 24-26 are dependent upon the amended claim 19, they should be allowed if the amended claim 19 is allowed. Reconsideration of claims 24-26 is therefore requested.

Examiner:

4. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over US# 6,001,512 to Tzu et al. in view of US# 6,294,295 to Lin et al.

Tzu teaches the limitations discusses above in paragraph 2 and

suggests the limitations discussed above in paragraph 3. Tzu teaches an attenuating phase shift mask but does not teach 180 degree phase shift. Lin teaches an attenuating phase shift mask that provides a 180 degree phase shift (Abstract).

The references are analogous art as they are drawn to attenuating phase shift masks with contact hole patterns. It would be obvious to one of ordinary skill in the art to use the 180 degree phase shift in Tzu as Lin teaches that a 180 degree phase shift is common in attenuating phase shift masks.

Response:

Claim 1 has been amended in the above AMENDMENTS TO THE CLAIMS section to introduce the limitations of comprising dense figures and at least one isolated figure in the integrated circuit layout.

As discussed in the response to the rejection over claim 19, the amended claim 1 has the same limitations as the amended claim 19 and is believed substantially different from Tzu et al.'s invention. The test lines 34, 36, and 38 taught by Tzu et al. cannot be read as the integrated circuit layout of the present application, and the sub-resolution contact holes 20 taught by Tzu et al. cannot be read as the dummy patterns of the present application to reduce the difference in pattern density of the integrated circuit layout for modifying optical proximity effect.

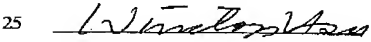
In addition, the amended claim 1 of the present application discloses that a phase difference of 180 degrees is detected between a transmitted light of the **integrated circuit layout** and a transmitted light of the **dummy patterns**. However, Lin et al.

teaches that a **patterned layer** of first attenuating phase shifting material 124 provides a 180 degree phase shift relative to light passing through the **transparent mask substrate** 122 at the first holes 118 (col. 4, lines 33-36). Lin et al. merely teaches a common phase shift mask providing 180 degree phase shift, and has never taught a **phase difference between two patterns formed on a photo-mask**, as is provided by the present application. The Applicants therefore respectfully believe that the amended claim 1 is substantially different from Lin et al.'s invention.

From the aforementioned reasons, the Applicants believe that one of ordinary skill cannot combine Tzu et al.'s invention with Lin et al.'s invention to accomplish the present application. Reconsideration of the amended claim 1 is politely requested.

As claims 2-10 are dependent upon the amended claim 1, they should be allowed if the amended claim 1 is allowed. Reconsideration of claims 2-10 is therefore requested.

Sincerely yours,



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